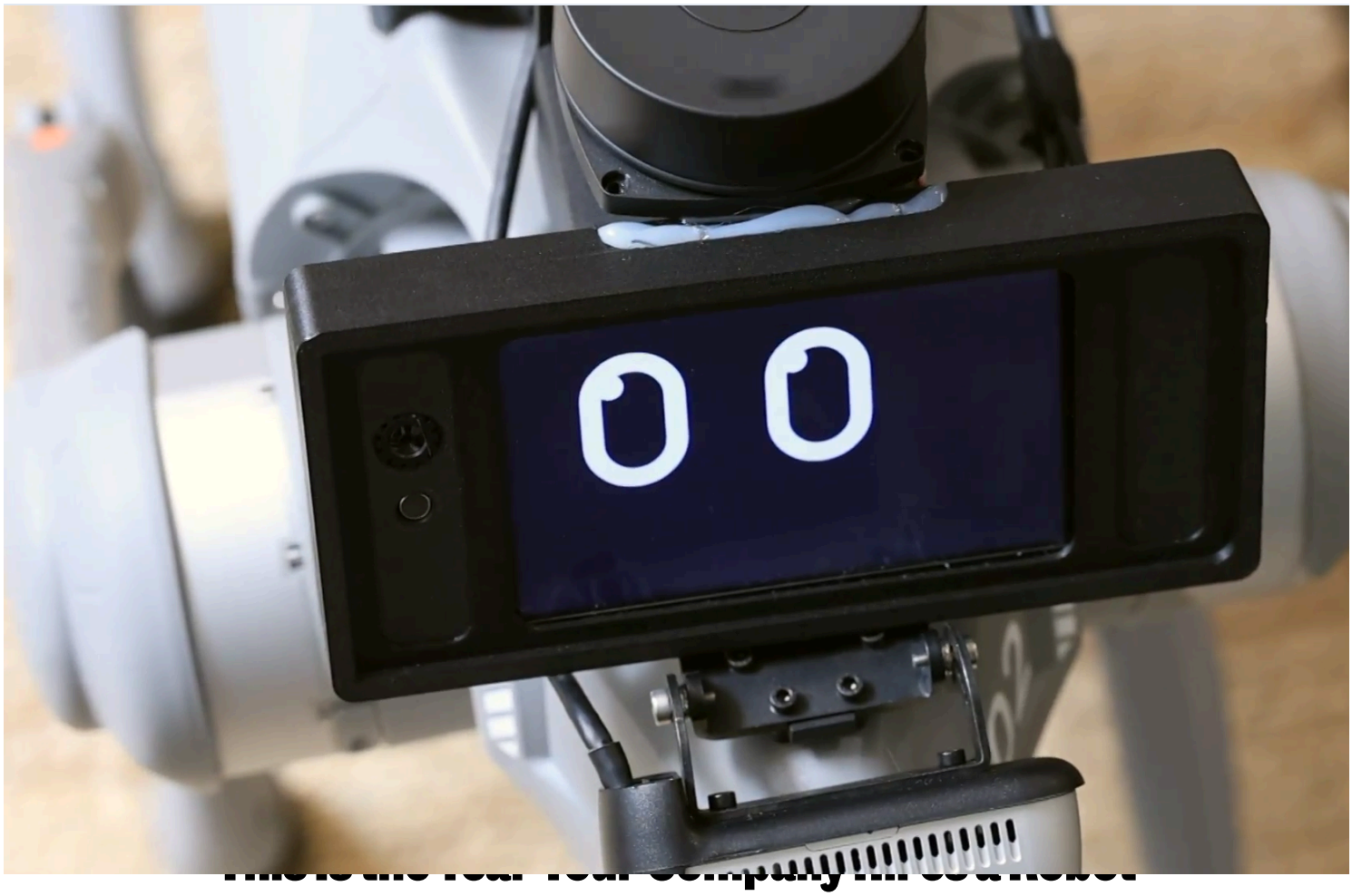

What is the real 'real' cost of a robot?

Rapid advancements in robotics (thanks, AI!) are creating opportunities in industries as varied as construction, dining, and health care.

BY ALISON J. STEIN

APR 2, 2026

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If you're craving a slice of pizza as you pass through the airport in Columbus, Ohio, a robot can handle that. Or, more precisely, two robotic arms can.

In mid-2025, pizza chain Donatos added what it bills as the world's first autonomous pizza restaurant to its more than 170 pizzerias. At the fully enclosed kiosk, patrons can watch the robotic arms form a ball of dough; apply exact amounts of sauce, cheese, and freshly sliced pepperoni; put it in and pull it out of the oven; and cut and serve it via an automat-style pass-through.

"All in under six minutes without a human involved," claims Kevin King, president and CEO of the Columbus-based company, founded in 1963. And that's just the beginning: He hopes to test pizza delivery via flying robots (also known

says King.

In this Inc. Premium article, you'll learn:

- Why analysts predict the humanoid robot population could reach 300 million in the next 15 years.
- How companies in a variety of industries are using AI-powered robots now
- Which tasks are best suited for robotic workers—and which are not

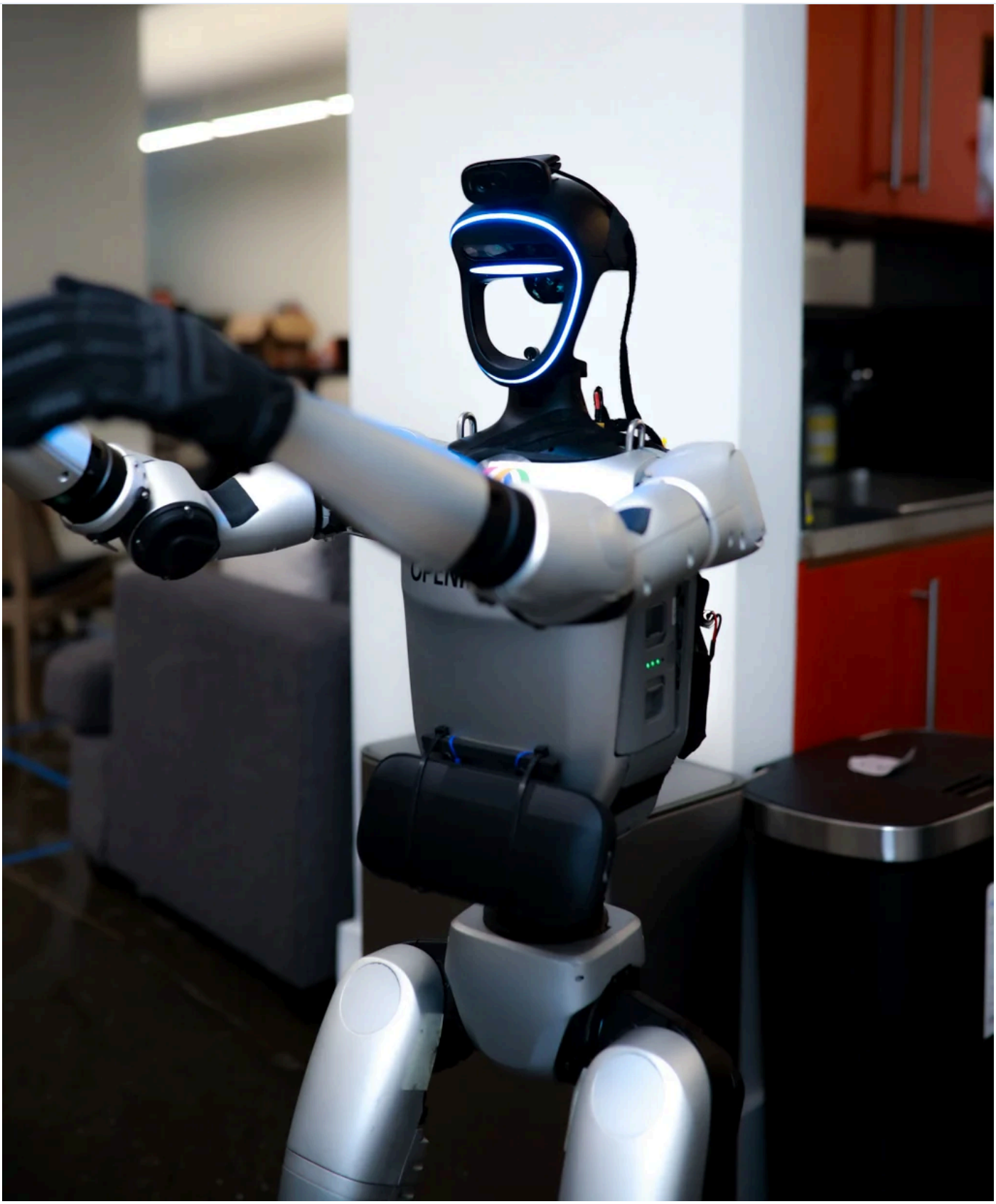
The robotic pizza debut of Donatos joins a steady stream of cross-industry headlines about developments in robotics. (When robots are equipped with AI, they are now also called physical AI, or embodied AI.) This year, within the space of weeks, the news brought stories of robots built in human form, also known as humanoids, performing at China's massive Spring Festival in Beijing, a one-armed robotic assistant helping nurses at a hospital in Los Angeles, the first lady inviting a robot to speak at a White House event, and Carnegie Mellon opening its new $100 million Robotics Innovation Center, with FieldAI (valuation $2 billion) as its inaugural tenant. Its new Pittsburgh neighbors include robotics powerhouses Skild AI, Agility Robotics, and Gecko Robotics, all of which announced hundreds of millions of dollars of VC funding in 2025.

Carnegie Mellon Robotics Innovation Department. Photo: Courtesy Carnegie Mellon

any signs of slowing. Some 500,000 industrial robots were installed in 2024 alone, according to the International Federation of Robotics, double the number from a decade ago. The world of physical AI is even larger, spanning autonomous vehicles, drones, task-specific robots, robotic arms, and, yes, humanoids.

While humanoids are mostly found in research settings in the United States today, the boom is coming, predicts Bank of America. Its most recent forecast projects that the number of humanoid shipments worldwide will surge to 10 million in 2035, and the robot humanoid population could reach 300 million by 2040. (For perspective, the U.S. population is currently about 342 million.)

Some say they're coming even sooner than that. "This is the year," declares Jan Liphardt, a Stanford professor and founder of the San Francisco-based robotics software company OpenMind, which raised $20 million in VC funding last year. "More and more Americans are going to see more and more humanoids in more and more situations."



Humanoid robot from OpenMind. Photo: Courtesy company

So whatever industry you're in, it's time to start thinking about integrating humanoids or other robots into your business plan. To do that, you need to go beyond controlled demos and edited videos to understand what robots can do

Advancements in Humanoid Robots

Humanoids are the most eye-catching robotic form, or embodiment, mapping most neatly onto what science fiction has long primed us to expect. Beyond the narcissistic appeal, many argue that robots in our own form hold the most long-term potential for regular use, because, at the risk of stating the obvious, the world is designed for the human shape.

But humanoids aren't yet the most useful or advanced robotic embodiment. "Most humanoids still feel like a science project," explains Liphardt. Limited battery life is one issue: "Every two hours, a 40-kilogram humanoid needs to sit in a chair and you have to lift its arm, take the battery out, plug the battery in and wait for it to charge, then put it back in and turn the robot back on." Also, until recently, "most humanoids had these super loud cooling fans. It was like sitting next to a hairdryer." Plus, they're heavy: You really don't want one to step on your foot, much less fall on you. (Or lose control in a small space while dancing.)

Yet Liphardt is bullish on humanoids' imminent widespread adoption precisely because these issues have risen to the top of the engineering agenda, past basic speech and navigation: "Now we can make [humanoids] safe and convenient, cost-effective and reliable, and all the other things people expect for a machine that lives with them."

He acknowledges the tech isn't there yet for humanoids to perform all tasks, or even basic ones requiring fine motor skills. (Creating fully functional hands is a hot topic in the humanoid game.) But he also doesn't think widespread

that do not involve 10-fingered fine motor skills." Thinking machines don't need hands to interact socially, teach, patrol, sort and stack, or deliver a package, he argues. Where grip is necessary, "generally, it's as simple as adding a hook," he says.

Think Beyond the Humanoid

No humanoids work at Dandy, a 2,000-employee New York City dental tech company, says Sriny Sundararajan, vice president of robotics and advanced manufacturing. But the company's lab, where it manufactures restorations (crowns, bridges, and so forth), uses physical AI and robotics. For the most part, humans and robots work together, he explains. Robots help load materials into machines that humans are operating, for example. There, "we have taken away the work of the hands and the legs, and we are leveraging the brain of the human," he says.

The thinking work is also getting offloaded to machines, he says. For example, restorations need to be manufactured to color-match a patient's surrounding teeth. Until recently, this required a human to compare a tooth against a "shade tab," an array of fake teeth in every imaginable shade of off-white. It was slow and painstaking work.

Now, an AI-enabled machine handles the preliminary matching and flags color differences, which speeds up the process considerably. "Most of the work is done by the machine," says Sundararajan. "But we still have a human make the final judgment call."

The More Critical the Task, the More You Still Need Human Judgment

This is very much the current state of things: Very few, if any, physical AI systems are operating without a human standing by.

At the Donatos robot pizza kitchen in Columbus, for instance, a partnership with airport catering vendor HMSHost ensures that humans are never too far away, for routine cleaning and restocking, or any necessary troubleshooting. Even Waymo, the most visible autonomous physical AI in use today, has immediate access to human operators when its onboard system encounters challenges it can't manage, a revelation that recently caused a stir at a U.S. Senate committee.

Donatos pizza robot. Photo: Courtesy company

That's because even when a theoretically autonomous robot can perform a task reliably in controlled conditions, it's far less reliable when things get unpredictable. "You have these really powerful systems that work quite well, but the envelope is hard to characterize," says Sebastian Scherer, a Carnegie Mellon professor who is also a director at FieldAI, which just set up shop at the university's new Robotics Innovation Center. The envelope, here, is an engineering term for the circumstances included in the robot's training. A demo can look good in what he calls a "benign" environment. But the real world, say, your average business or a home, "is a very adversarial environment, super unstructured, all kinds of things on the floor, carpets, dogs," he says.

Photo: Courtesy Carnegie Mellon

While these adversaries can be incredibly minor to a human, at the Nvidia GTC 2026 conference, companies including Tesla, Physical Intelligence, Hexagon, Skild, and Agility described seemingly trivial factors (uneven lighting, temperature changes) causing robots to malfunction.

For example, Digit, Agility's humanoid, worked fine in the lab. But when the team took it to a client's warehouse, the floor was dusty, not "a super nice epoxy floor lab environment," says Pras Velagapudi, the company's CTO. "And so we took Digit out to the site and *bam!*" This slapstick faceplanting was easily resolved by adjusting slip coefficients, he says. But the world's complexities go well beyond a dusty floor.

Sometimes these hard-to-predict errors can become "crazy mistakes," says Scherer. A robot outside its training can act randomly, and he's not using that term colloquially. Hypothetically, he says, imagine what would happen if a helicopter piloted by physical AI hadn't been trained on what to do if a roll is over a certain number of degrees. If that happened in flight, a human would instinctively understand without specific training that what matters most is getting the craft back upright. But if a robot also understood that, it would only be because of chance. It also might just flip the helicopter over.

What's more, even a robot equipped with excellent reasoning skills might not change the outcome, he says, because robots often don't realize when they're in a situation beyond their training. "They're very bad at estimating how much

and predictably in unexpected situations.

Delegate Well-Defined Repetitive Tasks

So while an all-purpose, set-and-forget humanoid robot isn't here yet, AI-powered robots in other shapes are already successfully tackling specialized tasks with some degree of autonomy.

Manufacturing and logistics have been the earliest adopters, where, even before AI, robots were managing tasks that are "dirty, dull, or dangerous," an alliterative mantra for current use cases.

FieldAI, for instance, has quadruped robots deployed at construction and industrial sites performing the kinds of monitoring tasks that require people "to wander around and gather information on a clipboard," Scherer explains.

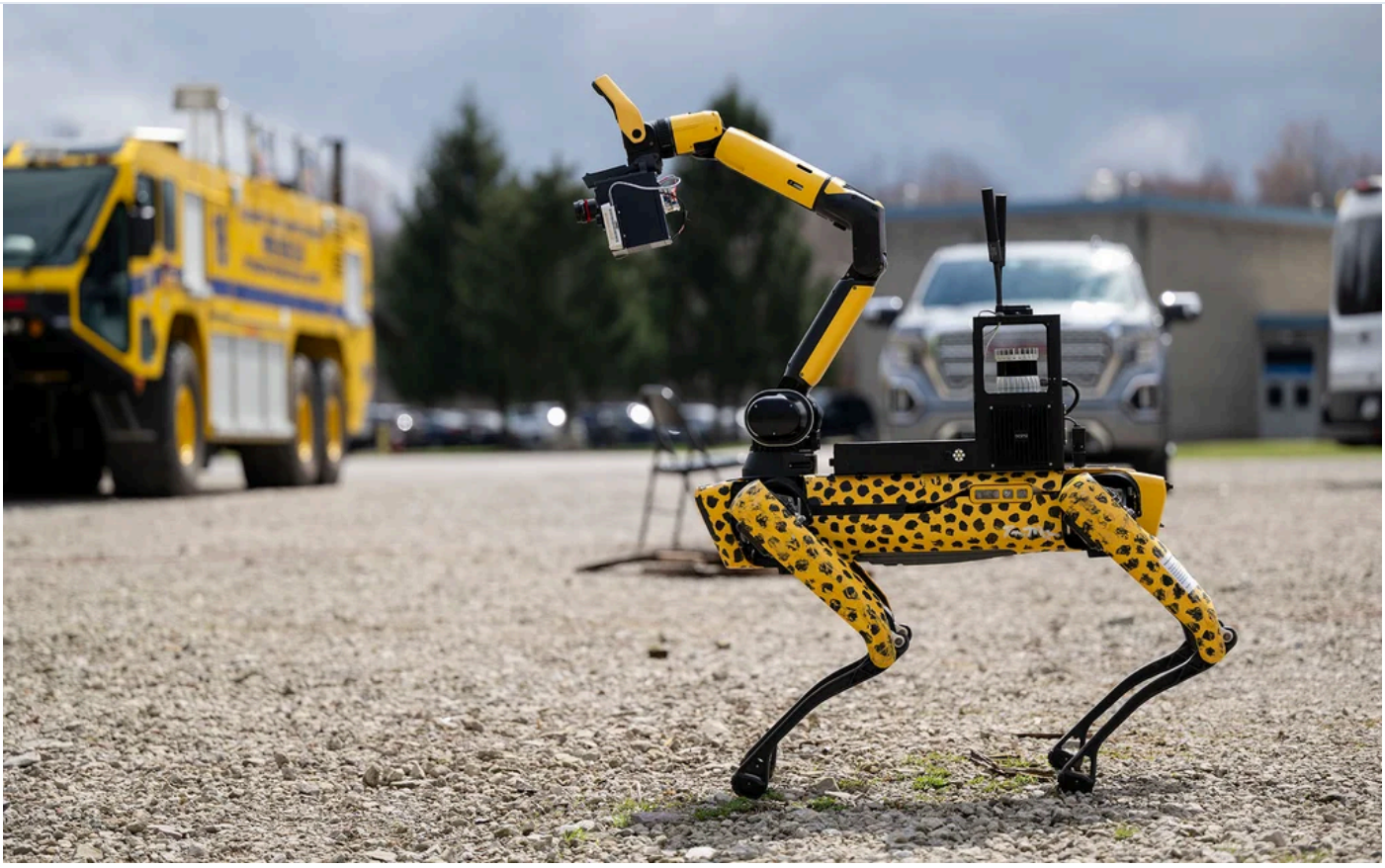
The "dull" jobs are also found in health care, says Liphardt, where the tedious nature of the work still requires specialized knowledge. For example, after surgery, operating room nurses must separate leftover detritus for proper disposal. OpenMind is working on a robot application for that: "The real opportunity for the human nurse is not to spend his or her time sorting trash. It's to interact with patients and do much more important things," he says.

Also, robots can staff places with uneven demand where it wouldn't be cost-effective to pay a human. For Donatos, it would have been a shaky business case to put a fully staffed pizza restaurant in the kiosk's location at the Columbus airport, given variable foot traffic and demand. But without the staff, the math pencils out differently. King says the company is now considering adding robot pizza kitchens in other, less-trafficked places they haven't been able to cost-effectively serve, such as office parks, apartment buildings, and even toll plazas.

Paying for the Robots

Speaking of costs, how much should you put in your robotics budget? While costs have been falling, functional humanoid robots are definitely not cheap: Bank of America's report estimates a production cost of $90,000 to $100,000 per unit. However, some already are built for less: The cost of materials for China-built humanoids was $35,000 in 2025, expected to fall to $17,000 in 2030. (China has a huge global supply chain advantage in the components required to manufacture robots of any kind; Japan also has significant advantages in industrial robotics.)

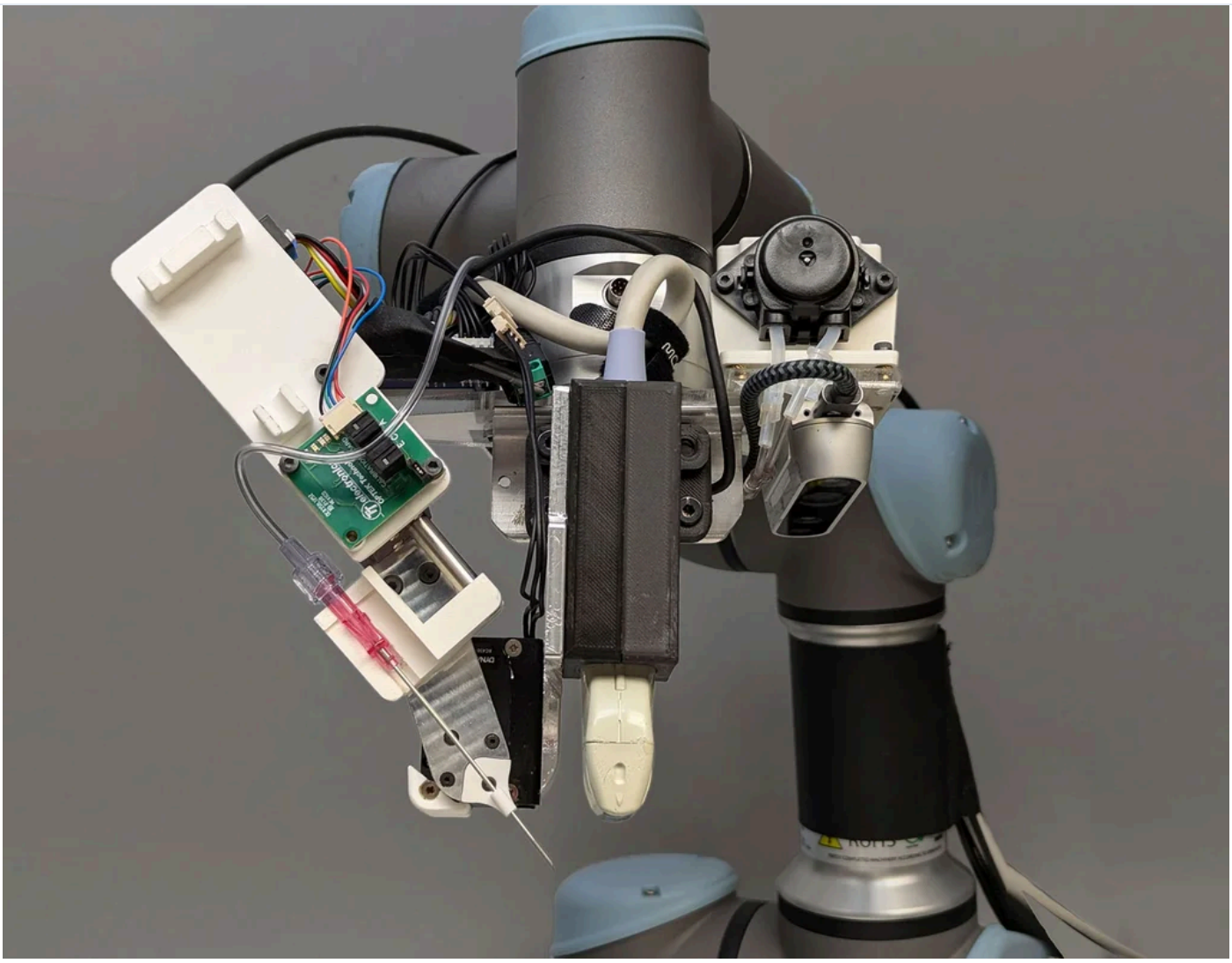
Quadrupeds and other robotic embodiments are also a great deal less costly than humanoids, measured in the thousands of dollars. But even as the upfront investment declines, the ongoing maintenance of sophisticated physical machinery and software will also be costly. Already, many companies are looking to Robots as a Service models, or RaaS, according to the International Federation of Robotics. It estimates that the number of these contracts for professional service robots increased by 31 percent since 2024.



Darpa, Carnegie Mellon. Photo: Courtesy Carnegie Mellon

Move Deliberately and Track Your Learnings

So what does all this mean for a typical office environment? The current and near-term opportunities are rather less obvious, but “these systems can take over routine, low-value tasks,” says Zoey Jiang, professor at Carnegie Mellon’s Tepper School of Business. Candidates to consider: sorting mail, moving equipment, delivering intra-office items. While robots are typically much slower than a human at these tasks (sometimes 10 times as slow), they compensate by working longer.



Medical robotics and AI at Carnegie Mellon. Photo: Courtesy Carnegie Mellon

Jiang suggests starting slow, with a few narrow tasks. She recommends tracking not just performance, but also integration: what the robot is doing (task completion time, error rates) and how employees are learning to work with it effectively. More than just a research curiosity, this will also help you figure out whether the robotics investment is making a difference for your bottom line, and how that may change over time.

“The technology will improve,” she says. “But the real differentiation will come from firms that build this learning capability early. Two companies can buy the same robot, but the one that learns faster, about where it works and how people use it, will get much more value.”

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